Energy basics 1	Semester: S5

EU objectives

At the end of this course, students will be able to :

- solve cases of fluids in equilibrium (hydrostatics and buoyancy) ;
- write and explain the local equations governing isovolume flows and the global equations, including Bernoulli's formula (ideal fluid);
- apply Bernoulli's equation to simple, classical cases to determine pressure or velocity fields and to solve drainage problems;
- identify the differences between an ideal fluid and a real fluid.
- analyse real isovolume fluid mechanics problems
- calculate singular and regular head losses in a fluid installation
- carry out a similarity analysis and define the most significant dimensional parameters for internal and external flow
- understand and explain the axiomatic formalism of thermodynamics developed at INSA;
- recognise and apply the usual and special problems of thermodynamics.

Description of the ECUEs

IDEAL FLUID MECHANICS

- Useful mathematical tools in fluid mechanics.
- Physical data and laws of behaviour.
- Kinematics of fluids and special movements; conservation of mass; fluid lines (streamlines and trajectories).
- Equation of statics; law of hydrostatics; statics of fluids in the field of uniform gravity; Archimedes' theorem; Pascal's principle.
- Fluid dynamics; ideal fluid dynamics and applications.

NEWTONIAN VISCOUS FLUID MECHANICS

- Definition of viscosity and properties of viscous fluids
- Viscous and incompressible fluid dynamics: Navier-Stokes equations.
- Pressure losses in pipes: generalised Bernoulli equation, regular losses, singular losses.
- Dimensional analysis and similarity

GENERAL THERMODYNAMICS 1

- Physico-mathematical prerequisites: balance equations, ordinary and exact differential forms, integrals and integration.
- First and second principles and their consequences in terms of variance and total spaces.
- Specific total spaces for work on the Legendre transformation and calorimetry.
- Thermodynamic potentials and initial consequences.

Prerequisites
Vector operators, partial differential equations, integration, linear algebra, classical thermodynamics.
Bibliography
Mécanique des fluides, éléments d'un premier parcours CHASSAING P. 3rd edition, Cépadues, 2010. Thermodynamics, ROCARD Y. MASSON & Cie, 1952.